December 15, 2000

Absolute Flux Measurement – Preliminary Summary

Appendix: Hysteresis of x controller position readout

Fall 2000 Test Run

G. Mitchell

The measurements of the x profile of the beam shown in Fig. 7 have centroids that differ from the arbitrary zero by up to 3 mm. This is shown in the figure included in this appendix. The four scans from Fig. 7 are shown, as are two slices of the x-y scan of Fig. 6. Each scan was taken progressively from one side to the other, though some were from the left and some from the right. No systematic dependence on direction of travel is observed. The following three partially related factors provide an explanation for the observed shifts:

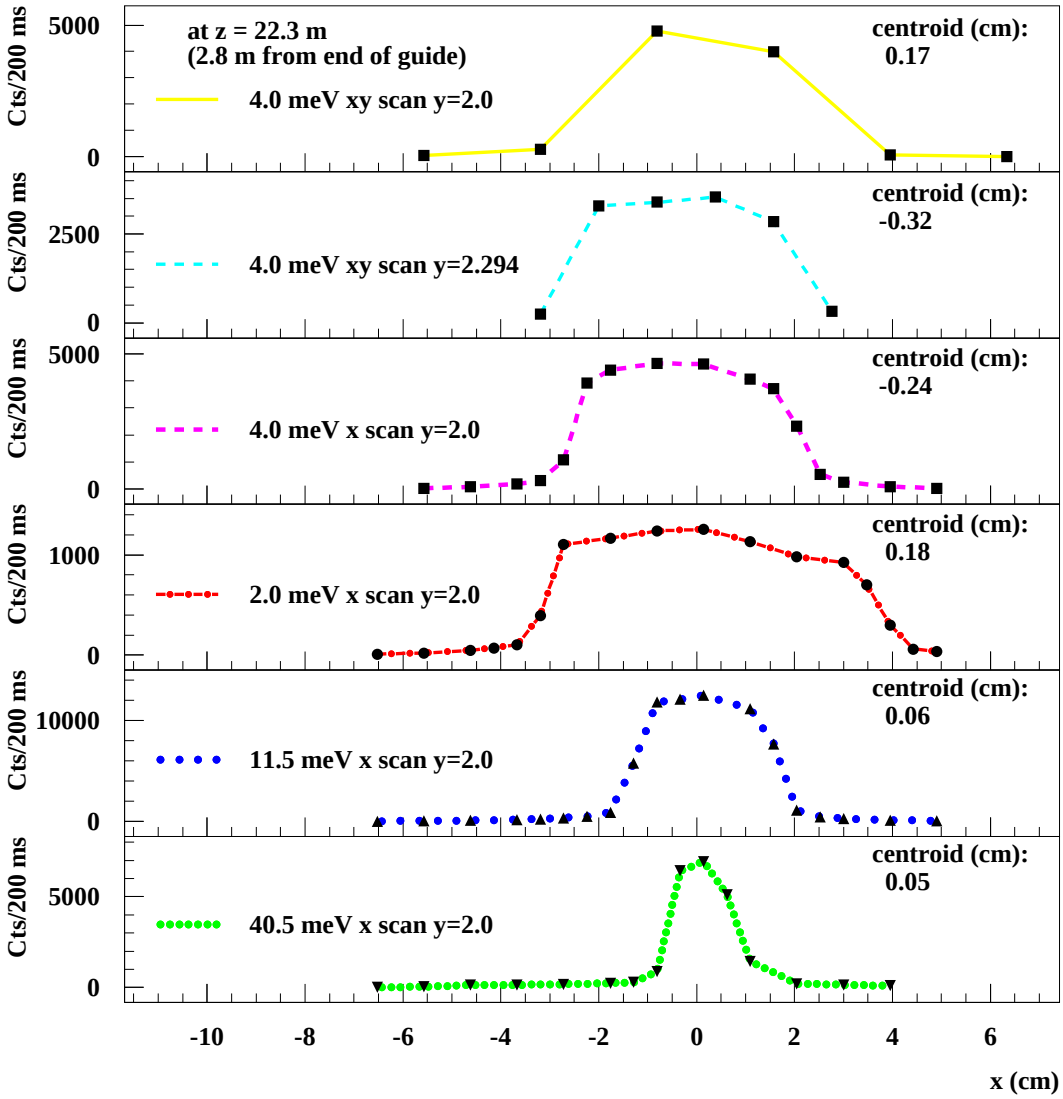
- A measurement of the controller hysteresis was made on August 24^{th}. The detector was moved from x = 5.383 kΩ to x = 2.486 kΩ, a distance of 14 cm. It was then returned to a marking at the original location, which corresponded to a resistance reading of x = 5.408 kΩ. The observed hysteresis effect is equal to 0.025 kΩ, or 1 mm.

- The readback contact on the x controller was broken and repaired prior to this hysteresis measurement and the test run. The repaired contact consisted of a bent thin piece of steel and conductive copper tape. The mount for the contact was not completely rigid and could have contributed to a larger hysteresis effect over successive measurements.

- When locating the detector for a measurement, a precision of typically 0.02 kΩ was used, corresponding to an uncertainty of 1 mm. Measurements at the edge of the beam, where the intensity varied rapidly with position, would be sensitive to this uncertainty. Measurements in the beam center and on the far edges of the beam would not be as sensitive.

Conclusion

The x locations of the neutron beam centroid differed in the various scans of the x beam profile performed for the flux measurement portion of the test run. The shifts are larger than a measurement of hysteresis in the x position readback, but combined with other factors (loose readback contact and precision in locating the detector based on the resistance reading) the observed shifts are small and do not indicate actual changes in the beam center. This hysteresis should not affect the measurements of the width of the beam and estimates of the neutron flux since each scan was performed sequentially across the beam.



Appendix figure: Counts vs. detector position for several scans in x at different beam energies. The top two scans are from the x-y scan data shown in Fig. 6, the lower four scans are from the width scans of Fig. 7.